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Conference Abstract

Working across Scales: Shared Building-Blocks of a Sustainable Infrastructure Environment for Bio/Geodiversity Data

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Abstract

The bio- and geodiversity communities aim to build digital infrastructures capable of delivering high-quality, well-structured, and richly interlinked data at a scale that enables powerful analyses to support the conservation and management of Earth's diversity. Informaticians, scientists, and resource managers face the challenge of globally accelerating and upscaling open data availability. Achieving this requires sustainable,

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resilient, and bi-directional socio-technical connections that promote interactions and feedback both ways across the data landscape. Such interactions will connect global and national repositories to local providers, data stewards, and data users in ways that are context-sensitive and adapted to partners' location, time and communities.

Although communities ranging from individual local experts to the governing bodies of global platform consortia are highly motivated and productive, they struggle to manage the rapidly growing volume of data, keep pace with technical innovation, and adhere to shared standards and best practices. Persistent challenges include insufficient recognition and visibility for contributors; functional and operational limitations in infrastructure; and inadequate long-term funding. Although the importance of the life cycles of data, infrastructures, and services is well-recognized, insufficient expertise in assessing the value that they represent and generate, and integrating those benefits into global, whole-community finance strategies presents an additional challenge. However, methodologies developed by global initiatives such as the United Nations System of Environmental-Economic Accounting (SEEA; United Nations et al. 2025) and UN Biodiversity Finance (BIOFIN; Cruz-Trinidad et al. 2024) provide innovative examples for addressing these. Without mechanisms that return generated value to data providers, stewards, and infrastructure developers, the community cannot initiate the self-reinforcing cycle of social and technical capacity growth needed for global upscaling. Instead, the current resource-limited landscape threatens the robustness of community networks and the long-term sustainability of existing infrastructures.

The insights from comprehensive community outreach and infrastructure reviews conducted by the U.S.-based BIOFAIR (Building an Integrated, Open, Findable, Accessible, Interoperable, and Reusable) Data Network form the foundation for a living roadmap designed to support effective solutions and sustainable models for global biodiversity data infrastructures (Kunkel et al. 2025). Informed by these findings, the International Partners for the Digital Extended Specimen (IPDES) network are discussing shared and unique strengths and gaps across partners at different levels in this ecosystem. Adding theory of change (Rice et al. 2020), as well as socioeconomic and biodiversity finance considerations to the BIOFAIR roadmap, members of IPDES developed an extended model of infrastructure sustainability and a project proposal. Key elements include:

1. involving economists in the process of integrating data, infrastructure, and services in information-economy value chains into natural capital accounting frameworks (e.g., SEEA), and developing comprehensive finance plans for bio/geodiversity data (e.g. adapting the methodology of BIOFIN);
2. building governance and organizational frameworks that support transparent, community-centered decision-making;
3. engaging the global community through coordinated participation and shared infrastructures;
4. conducting pilot implementations that apply accounting methods to key use cases; and

5. performing risk assessments of, and establishing safeguards for, the arising feedback loops in a socioeconomic system of returning value to data providers, stewards and users.

Together, these actions outline a path toward community-wide finance strategies that can support sustainable, scalable, and globally coherent biodiversity data infrastructures.

Keywords

biodiversity, data infrastructures, International Partners for the Digital Extended Specimen (IPDES), sustainability

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Conflicts of interest

The authors have declared that no competing interests exist.

References

- Cruz-Trinidad A, Cumming T, Bellot M, Barois H, Seidl A, Heuvel Ovd, Orozco AL, Arlaud M, Bortolotti E, Fischer R, Gupta G, Lanfranco P, Mweemba B, Shalakhanova A, Paxton M (2024) The BIOFIN Workbook 2024: Finance for Nature. The Biodiversity Finance Initiative. United Nations Development Programme, New York.
- Kunkel DM, Long-Fox BL, Pittman C, Portmann J, Sheik M, Bates JM, Bentley A, Contreras DL, Ellwood ER, Lomas MW, Monfils AK, Moser WE, Nelson G, Poo S, Thiers B, Watkins-Colwell GJ, Webster MS, Zimkus BM, Pandey JL (2025) Integrating

biological and environmental data to solve key scientific and societal challenges. BioScience https://doi.org/10.1093/biosci/biaf150

- Rice WS, Sowman MR, Bavinck M (2020) Using Theory of Change to improve post-2020 conservation: A proposed framework and recommendations for use. Conservation Science and Practice2-301. https://doi.org/10.1111/csp2.301
- United Nations, European Commission, Food and Agricultural Organization of the United Nations, Organisation for Economic Co-operation and Development, United Nations Environment Programme, World Bank (2025) System of Environmental-Economic Accounting: Ecosystem Accounting. United Nations https://doi.org/10.5089/9789212591834.069